MASS. HS30.1302: R19

UMASS/AMHERST

312066 0282 3935 3

DRAFT

FOR PUBLIC COMMENT

Rationale and Impact of Proposed Part M and Part M1 Regulations

THE COMMONWEALTH OF MASSACHUSETTS
Department of Public Health
Radiation Control Program
305 South Street
Jamaica Plain, MA 02130
(617)727-6214
FAX: (617)727-2098

931/344

EXECUTIVE SUMMARY

M.G.L. c.111H, the Massachusetts Low-Level Radioactive Waste Management Act (Act), has provisions which require the Department of Public Health to make regulations, compatible with the federal program, to control the generation, treatment, storage, and disposal of low-level radioactive waste. M.G.L. c.111H was passed in December 1987 in response to two federal laws, the federal Low-Level Radioactive Waste Policy Act of 1980 (Public Law 96-573) and its Amendments, the Low-Level Radioactive Waste Policy Amendments Act of 1985 (LLRWPAA, P.L. 99-240)(Federal Amendments Act). The Federal Amendments Act set milestones and deadlines that would require each State to be responsible for providing disposal capacity for all the commercial low-level radioactive waste generated within its borders after January 1, 1993.

The proposed regulations in Part M and Part M1 are in response to the mandates of M.G.L. c.111H.

The Act requires that the draft regulations be issued for public review and comment together with a statement of any major alternative regulatory approaches and performance objectives that were considered but not proposed and the reasons for the approach chosen. The Act also requires that the statement examine the significant public health, environmental, social and economic impact of current low-level radioactive waste management practices and regulatory programs; such impacts as are likely to result from the adoption of the proposed regulations and from major alternative regulatory approaches considered. The Act calls for an examination of the impacts likely to result from improper packaging, transportation incidents, improper design or operation of a facility, natural disaster, or inadvertent or purposeful intrusion into the facility. M.G.L. c.111H § 16(c)(1-3).

This statement has been prepared in compliance with M.G.L. c.111H section 16 (c). The statement describes, in brief, current low-level radioactive waste management practices and regulatory programs, with the proposed regulations presented as derived from current regulatory programs incorporating the requirements mandated in M.G.L. c.111H. The statement assesses the impacts of current LLRW management practices and regulatory programs and the impacts likely to result from the adoption of the proposed regulations in Parts M1 and M of 105 CMR 120.000. It describes the purpose of and need for adopting the regulations and evaluates the potential impacts these regulations may have on the environment, the regulated entities, and the residents of Massachusetts. A comparison of the potential beneficial and adverse impacts of the proposed regulations is presented together with an evaluation of the alternative regulatory approaches considered by DPH. The potential environmental, socio-economic, and health impacts of the proposed action and those of the alternatives have been evaluated, providing the basis for the selection of the preferred alternative.

RATIONALE AND IMPACT ANALYSIS OF PROPOSED PART M AND PART M1 REGULATIONS

Table of Contents

I	**INTRODUCTION**	. . . . .	1
	A	Proposed Action	1
	B	Statutory Basis for the Proposed Action	1
	C	Scope of Proposed Action	1
	D	Purpose and Scope of Impact Statement	2
	E	Scope of Current LLRW generated in Massachusetts .	2
II	**Alternative Regulatory Approaches**	. . . . .	4
	A	No State Involvement; NRC Regulated	4
	B	State Adoption of Part 61 Verbatim	5
	C	State enter into Limited Agreement	6
	D	State Regulating Disposal Only	6
	E	State Regulating all Radioactive Material Use . . .	6
III	**Reasons for Approach Chosen**	. . . . .	6
IV	**Impacts of Current Practices and Regulatory Programs**	. .	7
	A	Rationale	7
	B	Public Health Impacts	7
	C	Environmental Impacts	8
	D	Social and Economic Impacts	9
V	**Impacts of Department's Proposed Regulations**	. . . . .	9
	A	Rationale	9
	B	Public Health Impacts	15
	C	Environmental Impacts of Proposed Regulations . . .	16
	D	Social and Economic Impacts	16
VI	**Impacts from Improper Packaging, Transportation Incidents, Improper Design or Operation of a Facility, Natural Disaster, or Inadvertent or Purposeful Intrusion into the Facility**	. . . . .	16
	A	Rationale	17
	B	Improper Packaging	17
	C	Transportation Incidents	18
	D	Impacts of Improper Design or Operation of a Facility	18
	E	Impacts of Natural Disaster	19
	F	Impacts of Inadvertent or Purposeful Intrusion into the Facility	19
VI	**Tables**	. . . . .	21

Digitized by the Internet Archive
in 2014

https://archive.org/details/rationaleimpacto00mass

I. INTRODUCTION

A. Proposed Action

The Department of Public Health (Department) proposes to adopt a new set of regulations to control the generation, treatment, storage and disposal of low-level radioactive waste (LLRW) and the facilities used for the treatment, storage and disposal of LLRW. The proposed action, which is the subject of this draft impact statement, consists of promulgation of section M.1 through M.90 of Part M, and section M1.10 through M1.70 of Part M1. The proposed regulations contained in Parts M and M1, taken together, are the subject for public review and comment. When approved, these regulations will become part of the Massachusetts Regulations for the Control of Radiation, other Parts A-J and W have already been presented for public review and comment.

The proposed regulations in Part M establish performance objectives, criteria, terms and conditions governing the issuance of licenses for the treatment, storage and disposal of low-level radioactive wastes received from other persons, as well as the development, operation, closure, post-closure observation and maintenance, and institutional control of a low-level waste treatment, storage or disposal facility.

The proposed regulations in Part M1 require all radioactive material users and generators of low-level radioactive waste to examine their operations and institute waste minimization programs where appropriate. The regulations also require that all radioactive material users, who generate waste, submit to the Department a written statement describing their waste minimization activities.

Additionally, those persons whose operations result in 100 cubic feet or more of waste per annum, requiring disposal, are required to develop and institute waste minimization programs predicated on detailed plans.

B. Statutory Basis for the Proposed Action

The regulatory authority for the Department of Public Health to engage in the proposed action is found in:

- M.G.L. c.111, §§ 3, 5M, 5N, 5O, 5P;
- M.G.L. c.111H, §§ 1, 7, 8, 11, 13, 16, 31.

C. Scope of Proposed Action

The proposed regulations in Part M, which pertain to the receipt for treatment, storage or disposal of LLRW, affect the owner or operator of a facility, and contain provisions which apply to conduct by persons who generate LLRW anywhere who seek access to any facility licensed by the Department.

The proposed regulations in Part M1 apply to all radioactive material users, within the Commonwealth, who are required to have a license for possession. Part M1, also applies to any waste generators who would seek access to any waste facilities licensed by the Department.

The scope of the these proposed regulations is guided by the provisions in M.G.L. c. 111H which, require the regulations be compatible with the federal regulatory program, and that: (1) any disposal method used at a facility must permit monitoring and retrieval of waste and (2) shallow land burial be prohibited. M.G.L. c. 111H also requires the Department, after consultation with the Low-Level Radioactive Waste Management Board (Board), to establish a program for LLRW source minimization, volume minimization and storage for decay. M.G.L. c.111H also requires the Department to adopt regulations to implement the minimization program it develops after consultation with the Board.

These proposed regulations establish performance objectives for LLRW disposal facilities. They do not specify a disposal facility technology; they are, therefore, suitable for any site that might be selected under rules provided for in M.G.L. c. 111H. The regulations also set comparable standards for treatment and storage facilities. The regulations also establish enforcement procedures in case there are violations of the statute or the regulations.

D. Purpose and Scope of Impact Statement

The Act requires that draft regulations be issued for public review and comment together with a statement of any major alternative regulatory approaches and performance objectives that were considered but not proposed and the reasons for the approach chosen. The Act also requires that the statement examine the significant public health, environmental, social and economic impact of current low-level radioactive waste management practices and regulatory programs; and such impacts as are likely to result from the adoption of the proposed regulations and from major alternative regulatory approaches considered. The Act also calls for an examination of the impacts likely to result from improper packaging, transportation incidents, improper design or operation of a facility, natural disaster, or inadvertent or purposeful intrusion into the facility.

E. Current LLRW practices in Massachusetts

Activities in Massachusetts generated 56,527 cubic feet of waste in 1989 (see Table 1). There are no disposal sites presently in Massachusetts, so this LLRW is sent to one of the three existing sites in the U.S. at Barnwell, South Carolina, Beatty, Nevada, or Richland, Washington (see Table 2). Each site has restrictions on the waste it will accept based on the terms of its license and other restrictions imposed by the state in which it is located. In addition to the LLRW dispatched to the three commercial disposal sites shown in Table 1 some of the waste generated by academic, medical, and industrial sectors was disposed of by other means including storage for decay and subsequent disposal as normal trash.

The Massachusetts low-level waste for 1989 shipped to the three commercial disposal sites is broken down into class in Table 3. It is seen that 98% is Class A and 2% Class B and none in Class C. This composition of the LLRW shipped from Massachusetts to disposal sites is typical from surveys in other years.

Low-level radioactive waste produced by nuclear power plants ranges from activated structural components found within or in close proximity to the reactor environment to trash suspected to be slightly contaminated. It includes reactor components, tools, spent demineralizer resins, evaporator concentrates, used filters, and miscellaneous wastes such as rags, mops, paper, and protective clothing. These wastes are generally processed, packed, stored on-site, and ultimately shipped to licensed commercial LLRW disposal facilities.

In medical applications, radioactive waste arises as a by-product of the therapeutic uses of radiopharmaceuticals, from the use of radioactive substances in in-vivo and in-vitro diagnostic procedures and from the use of external radioactive sources for therapy. These various procedures fall under radiotherapy and a branch of medicine called nuclear medicine. More than 100 million nuclear medicine procedures are performed annually in the U.S.

Bioresearch waste results from the use of radioactive materials in biochemical, biophysical, and physiological investigations. Various radionuclides are used as tracers in test animals and for labeling organic molecules to study reactions and obtain basic medical information.

Radiopharmaceutical industries generate LLRW in the course of converting radioactive chemicals into radiopharmaceuticals (radioactive pharmaceuticals). One of the largest radiopharmaceutical firms in the country is E.P. Dupont located in Boston and Billerica.

A substantial portion of the LLRW generated by the radiopharmaceutical industry and from medical and research applications is comprised of short lived radionuclides. This waste is stored for decay on-site and then disposed of as regular waste. It is not sent to commercial LLRW disposal facilities. However, some of the useful radionuclides in these applications are long lived and need to be disposed of at commercial disposal sites.

There are other industrial operations which generate LLRW. These are usually in the form of sealed radioactive sources. The sealed sources are used in diverse ways; for industrial radiography, well-logging, and in measuring and gauging instruments. They must be disposed of once they come to the end of their useful life.

Much of the waste generated is processed to minimize it so as to reduce storage, transportation, disposal, and liability costs. Thus, the actual waste streams generated in Massachusetts in 1989, as shown in Table 4, amounted to 162,649 cubic feet; after volume reduction procedures the final amount was reduced to 63,185 cubic feet, of which 58,715 cubic feet was shipped to commercial disposal sites (Table 2).

The operations enumerated above, which generate LLRW, obviously have a significant positive impact on public health by way of providing diagnostic and therapeutic services. The bio-technology and pharmaceutical companies provide an industrial base and the utilities contribute energy into the electrical grid. They all provide significant employment within the Commonwealth and reduce the tax base. Disposal facilities for long-term isolation of the LLRW resulting from these various operations is essential for the continuation of these activities. Without proper disposal procedures such activities could be curtailed with adverse consequences for the Massachusetts economy.

There are economic benefits for the states with commercial disposal facilities. They have been able to levy increasing fees to receive waste for disposal; these fees help to reduce the tax base within those states. The high fees are possible because of the limited number of disposal facilities and the general unwillingness of many communities to accept them.

II. Alternative Regulatory Approaches

A. No State Involvement; NRC Regulated

An alternative regulatory approach would be to continue to allow the NRC to regulate all aspects of LLRW management in the Commonwealth. Presently, the Nuclear Regulatory Commission (NRC) is responsible for licensing and regulating all uses of radioactive materials in academic, industrial, and medical facilities except those that might fall under the purview of the Department of Energy

or Department of Defense. The NRC responsibility includes the generation and disposal of low-level radioactive waste. It discharges this responsibility either directly or by entering into agreements with states whereby the authority to license and regulate the uses of radioactive byproducts, source materials, small quantities of special nuclear materials, and LLRW is relinquished to the State.

Massachusetts is not an Agreement State, therefore, if the state took no action, LLRW would be regulated by NRC without any input from the Commonwealth. The NRC could license a disposal facility utilizing shallow land burial, a disposal method that is strongly felt not to provide adequate confinement of waste and is not thought to be acceptable to the general public in the Commonwealth.

The NRC's regulations for low-level radioactive waste disposal are codified in 10 CFR 61. The regulations established in 10 CFR 61 cover all phases of LLRW disposal from site selection through facility design, licensing, operations, closure, and post-closure stabilization, to the end of the period of active institutional control.

A state may enter into agreement with the NRC to take over the licensing of all the categories of materials specified above, in which case it becomes a full Agreement State, or it may opt to license a selected item, in which case it enters into a limited Agreement.

Enabling legislation must be passed by the legislature before a State can enter into agreement with the NRC. In addition, the State must certify that it has a program for the control of radiation hazards adequate to protect the public health and safety, and the NRC must find that the proposed state program is compatible with the federal program and adequate to protect the public health and safety. States entering into such an arrangement are referred to as Agreement States.

The NRC has set the interpretation of compatibility to require uniformity of radiation standards with emphasis on technical definitions and terminology, maximum permissible doses, levels of radiation and concentrations of radioactivity, labels, signs and symbols. The NRC annually reviews the radiation control programs of Agreement States to determine whether the terms of the agreement continue to be maintained. The NRC may terminate or suspend the agreement and reassert federal licensing and regulatory authority if the program fails to meet NRC requirements. An Agreement State may also withdraw from the program with the NRC resuming its authority.

B. State Adoption of Part 61 Verbatim

Another alternative for Massachusetts would be to adopt the NRC's regulations promulgated in 10 CFR 61, verbatim.

The state could, under the Agreement State program, adopt 10 CFR 61 verbatim. This approach would be acceptable to the NRC but would not provide the greater protection sought by the Department and the public and provided for in M.G.L. c.111H. Such an approach neither addresses the intent to prohibit shallow land burial, nor does it address the intent to reduce waste generation to the minimum level possible.

C. State enter into Limited Agreement

The state could pursue a limited agreement with the NRC to regulate and license a LLRW disposal facility only. This approach would allow the Department to promulgate as rigorous regulations as it felt necessary for the control of LLRW disposal facilities. The Department, however, would not be able to regulate treatment and storage facilities.

The possibility of the loss of access to disposal facilities after January 1, 1993, and the likelihood that waste may need to be stored until access to disposal facilities becomes available, makes it desirable to have control of treatment and storage facilities so as to regulate them with the same high standard of safety as expressed in state law. As stated above, it is also desirable to have the ability to regulate for waste reduction.

D. State Regulate Disposal Only

The Commonwealth could seek full Agreement State status and promulgate specific regulations only for disposal facilities with the stringency provided for in the Act. With this alternative, the Department would be regulating treatment and storage facilities under general or specific licensing provisions of the Agreement State regulations. This approach, however, fragments the management of waste and does not recognize the interrelated nature of the various facets of waste management, leaving treatment and storage to be regulated on an ad hoc basis.

E. State Regulate all Radioactive Material Use

The Commonwealth could, not only seek full Agreement State status and promulgate specific regulations for the disposal facility, but also establish requirements that all users must follow so as to effect source and volume minimization goals. This should result in an overall reduction in the volume of waste eventually requiring disposal. This is the approach chosen.

III. Reasons for Approach Chosen

The approach chosen (E., above) allows the Department to regulate all aspects of LLRW, from the generation of waste through processing and disposal to long-term care after disposal site closure and ensures that treatment and storage of waste are provided for and regulated with the same degree of stringency as disposal.

This approach, while being fully compatible with NRC regulations, contains features that better provide for public health and safety. The proposed regulations in Part M, address areas of public concern in the Commonwealth. Following the mandates of M.G.L. c.111H, the regulations prohibit shallow land burial as a means of disposal and also require that any disposal facility licensed should monitor radioactive waste. They require in addition that there is the capability to recover the waste in intact waste containers, should that be necessary.

Institutional control of access to a facility after its closure is maintained for the length of the hazardous life of the radioactive waste. This is in contrast with NRC regulations which require institutional control of land disposal facilities for up to a maximum of 100 years after closure, irrespective of a continuing hazardous life.

The regulations in part M1, in requiring a deliberate effort to reduce waste, have the potential to reduce the demand for disposal capacity in compliance with state law. This requirement to reduce waste recognizes that, if less LLRW is generated, the public is less subject to the hazards of LLRW.

The residents of the site community will be encouraged and assisted to participate in environmental monitoring to confirm that the prescribed standards prevail.

IV. Impacts of Current Practices and Regulatory Programs

A. Rationale

Prior to the enactment of the Federal Low Level Waste Policy Act, the disposal of LLRW was accomplished by the process of shallow land burial. The three existing disposal sites were designed so as to allow burial of various types of containers of LLRW by emplacement in shallow trenches, which are then covered with a layer of soil. In 1983, the promulgation by the NRC of 10 CFR 61 provided specific requirements for the land disposal of low-level radioactive waste containing source, special nuclear, or byproduct material. Those regulations establish performance objectives for land disposal of waste and technical requirements for the siting, design, operation, closure, and long-term control for a near-surface disposal facility. Shallow land burial is permitted. Waste

classification was also defined in those regulations, as well as a requirement for institutional control of access to the facility for up to 100 years after closure.

B. Public Health Impacts

The significant public health impact of current practices is the potential for exposure of the public to ionizing radiation. This can be through direct exposure to radiation, infiltration of radioactive materials into the ground water and water supplies and accidental release to the environment.

The objective of any radioactive waste management program should be to ensure adequate protection against ionizing radiation arising from the waste.

The norms of radiation protection reflect the assumption that every exposure to ionizing radiation carries a health risk. The National Council on Radiological Protection (NCRP) has made risk assessments on the basis of the assumption that an individual's risk of being affected by radiation exposure is directly proportional to the absorbed dose in the relevant organs and tissues, and that there is no threshold value of the dose below which no risk exists.

Due to naturally occurring background radiation, there is an average annual dose to adults of about 250 millirem, of which about 40 millirem per year comes from naturally occurring radioactive material contained in the human body. Additional dose comes from man made sources, such as medical and dental x-ray procedures, and industrial, commercial and academic use of radiation devices and radioactive materials. Consequently, dose limitations to workers and the public are guided by three principles: (1) The practice leading to exposure should be beneficial to society; (2) there are dose limits which define the permissible radiation doses for workers and the public; (3) the radiation dose resulting from a necessary operation is as low as is reasonably achievable (ALARA). For the public, this dose is a small percentage of that received from natural background radiation.

In any operation which could lead to the release of radioactive material to the general environment, the NRC stipulates that it should not result in an annual dose exceeding an equivalent of 25 millirem to the whole body, 75 millirem to the thyroid, and 25 millirem to any other organ of any member of the public. The ALARA principle has become the basic tenet of radiation protection, most often leading to much smaller doses to the public than any prescribed dose limits.

C. Environmental Impacts

The most significant environmental impact of current LLRW management practices is on land use. The siting of a disposal

facility results in the setting aside, for one hundred years, a land mass of several hundred acres, which may not be used for any other purpose.

A second impact relates to current waste management practices which dispose of waste by shallow land burial. Waste disposal by shallow land burial in adverse conditions, may lead to the migration of radionuclides in the soil and into the water supply and potential contamination of the environment. The effect of such migration is to endanger the public by unnecessary exposure to radioactive matter.

Three of six commercial shallow land burial facilities operated in the United States have failed, releasing radioactive materials into ground water and surrounding environment. The siting and waste form requirements of present regulatory efforts are based on the lessons learned from the failure of the three disposal facilities. Although the perceived reasons for the failure of the earlier sites have been addressed in the current requirements, there continues to be concern that shallow land burial facilities are prone to failure in unexpected ways. Failure of a facility could lead to the migration of radionuclides into water supplies and the contamination of the surrounding environment.

D. Social and Economic Impacts

The major social impacts of current LLRW management practices include the economic depreciation of property values in the vicinity of the disposal facilities and the aesthetic issues associated with the concept of a shallow land burial site. The major economic impacts are the possible economic loss of value of the property on which the facility is located; the economic depreciation of property values in the surrounding neighborhood and the escalating costs in assuring that the radioactive waste does not migrate off the site.

The most significant socio-economic impact of current waste management practices is that waste disposal facilities are very difficult to site. Disposal facilities are unwelcome and resisted in most communities because they are regarded as a source of ill health and pollution of the environment.

A consequence of the difficulty in siting disposal facilities is that generalized community resistance to siting ("not in my backyard") could result in a lack of adequate capacity for the disposal of waste.This could threaten the activities which produce the waste.

V. Impacts of Department's Proposed Regulations

A. Rationale

The proper management of LLRW facilities has these objectives: protection of the general population from releases of radioactivity, protection of individuals from inadvertent intrusion, and protection of individuals during operation. A fourth objective is to ensure stability of a facility after closure.

Part M provides specific requirements for the issuance of licenses authorizing the treatment, storage, and disposal of low-level radioactive waste (LLRW) and naturally occurring and accelerator-produced radioactive material (NARM) waste. This Part(M) establishes performance objectives, and specific technical requirements for design, operation, closure and long-term control for low-level radioactive waste facilities. Part M also establishes institutional requirements, financial requirements, administrative and procedural requirements for licensing a LLRW facility.

Institutional control of access to a facility, after its closure, is maintained as long as the hazardous life of the radioactive waste. This is in contrast with NRC regulations which only require institutional control of land disposal facilities for up to 100 years after closure.

The regulations adopt NRC standards for the limits of doses that any member of the public may receive as a result of the operation of any LLRW facility.

The regulations require that every reasonable effort be made to limit releases of radioactivity in effluents, and radiation exposure during operations as low as is reasonably achievable (ALARA). To this end, the regulations require that facilities be sited, designed, operated and controlled after closure under certain performance objectives (ss.M.11-14).

The proposed regulations also require that any licensee who transfers radioactive waste to a disposal facility or to a licensed collector or processor must classify the waste into one of three classes (Class A, Class B, or Class C). Class A poses the least and Class C poses the greatest potential hazard to the public and the environment. All three classes must meet minimum waste form and packaging criteria to facilitate safe handling and the protection of personnel. Class B and C wastes must also meet stability requirements intended to minimize water infiltration and leaching of radionuclides from the waste. Class C waste requires further measures to protect inadvertent intruders from the hazard of external radiation exposure and must have appropriate markings.

There are two other categories of LLRW besides those specified as classes A,B,C. These are the category designated as "greater than

Class C" (GTCC) and the category designated as "mixed waste". The category GTCC, covers higher concentrations of the relevant radionuclides which, consequently, pose even greater potential hazard than Class C and require even more stringent disposal. The second category, mixed waste, is waste that contains a radioactive component that would normally place it in one of the specified classes of waste, and a hazardous component, and therefore requiring to be treated differently than as simply radioactive waste; in some instances, the radioactive component and the hazardous component may be the same substance.

The purpose of a waste classification system is to separate wastes into categories so as to specify the management of each type : treatment, long or short term storage, containment or other process.

There are no commercial sites currently accepting GTCC waste. GTCC waste is stored at the facility of generation pending future guidance from the NRC.

The disposal of mixed waste is subject to regulation by both the Environmental Protection Agency and Nuclear Regulatory Commission, and thus in Massachusetts will be regulated jointly by Department and the Department of Environmental Protection. One approach for dealing with mixed waste is to separate the hazardous component from the radioactive component, where this is technically feasible and the regulations allow it.

There are certain minimum requirements for all classes of waste which are intended to facilitate handling and provide protection of health and safety of personnel at disposal facilities. There are, also, minimum requirements intended to provide stability of the waste. Stability is intend to ensure that the waste does not degrade and affect overall stability of the facility through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. Stability is also a factor in limiting exposure to an inadvertent intruder, since it provides a recognizable and nondispersible waste.

Each shipment of waste to a licensed facility must be accompanied by a shipment manifest. The information in the manifest assists in choosing appropriate emergency response in the event of a transportation accident. The manifest provides a means of tracking LLRW as it moves between the generator, broker, treatment and disposal facilities.

The US Department of Transportation (DOT) and the NRC are the major regulators of LLRW transport. In addition, States and local governments have various further restrictions. The Department of Transportation promulgates and administers interstate transportation regulations pertaining to packaging, personnel and vehicle requirements, low-specific activity waste, and small

quantities of waste. The regulations are designed to allow the routine movement of most DOT radioactive materials while ensuring public and environmental safety. The NRC is responsible for regulating transfer of those that exceed the small quantities regulated by DOT. The regulations are designed to minimize radiological hazards to the public and to safeguard wastes from theft and sabotage. Regulations governing intrastate transportation of low-level waste are the purview of individual states. Most states have adopted federal regulations; Massachusetts has adopted federal regulations for the transportation of radioactive materials including waste. Further requirements, not in conflict with DOT regulations, regarding notification and the use of the Massachusetts turnpike have been made.

The proposed regulations in Part M do not stand alone. They operate in conjunction with other regulations, including those in Part C and Part D, which set standards for waste classification, waste characteristics, labeling, and a manifest system. Together, they are fully compatible with the corresponding federal regulations. They codify and set standards for the safe management of low-level radioactive waste, linking waste handling by generators with final disposal. Additionally the Part M1 regulations apply to all radioactive material licensees and waste generators who require access to disposal facilities in Massachusetts.

B. Public Health Impacts

The significant public health impacts of the proposed regulations will be the assurances that the public will not be adversely impacted by the operation of any low level radioactive waste facility licensed under these regulations. The requirements for initiatives to maintain releases of radioactivity in effluents to ALARA, for ensuring protection of the site from inadvertent intrusion, for protection of individuals during operations , and for maintaining this protection after closure will all significantly contribute to the protection of the public health.

The basic philosophy behind the technical requirements of these regulations is that the siting, design, and waste form requirements relate to both stability of the disposal site and control of releases within acceptable limits. The natural ability of the site to contain the waste is relied upon for a longer time, since the waste form and design features will decrease in effectiveness over time. By adopting these siting and waste form requirements and also requiring waste to be disposed of in engineered structures, another level of control of waste is added.

The requirement for monitored retrieval, so that waste may be recovered in intact container in the event of release or the threat of release, builds in another level of control of releases. The requirements for the redundant systems increase the level of

protection of public health and safety. Lastly, the requirement to maintain institutional control of access to a facility, after its closure, as long as the hazardous life of the radioactive waste will provide better protection against inadvertent intrusion onto waste.

C. Environmental Impacts of Proposed Regulations

The proposed regulations will better protect the environment from contamination through migration through the soil and water by requiring waste to be disposed in engineered structures instead of in unlined trenches. The environment is further protected by continuing institutional control for longer, thereby, preventing the disturbance, and subsequent dispersion of any disposed waste.

The requirement to maintain institutional control until any waste present at the site has decayed to below acceptable limits for release into air or water in unrestricted areas, insures that the land will not be prematurely released for public use.

D. Social and Economic Impacts

The proposed regulations establish adequate criteria necessary to ensure that any facility that may be licensed under them will not constitute a hazard to public health and safety and the environment. The impact of these regulations could lessen the public perception that waste facilities are sited without concern for public health and safety or protection of the environment.

The regulations show sensitivity to the concerns of the public by: (1) taking steps to control the amount of waste generated, and (2) making it possible for the public in the site community to participate in environmental monitoring programs to confirm that the prescribed standards of safety are being met.

While the redundancies in waste isolation may increase the costs of a facility which, eventually, may be passed on to the general public, it is believed that the increased protection of the public gained through these activities will justify these expenditures.

VI. Impacts from Improper Packaging, Transportation Incidents, Improper Design or Operation of a Facility, Natural Disaster, or Inadvertent or Purposeful Intrusion into the Facility

A. Rationale

Six commercially operated shallow -land disposal facilities have been licensed and operated in the United States. Three of the sites have been closed for over 10 years. The closed sites are in West Valley, New York; Maxey Flats, Kentucky; and Sheffield, Illinois.

The three sites that have remained opened are Beatty, Nevada (opened in 1962); Richland, Washington (opened 1965); and Barnwell, South Carolina (opened 1971).

A Department of Energy publication entitled DIRECTIONS IN LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT -A Brief History of Commercial Low-Level Radioactive Waste Disposal, DOE/LLW-103, October 1990, describes the operation of the six facilities as follows: "The overall performance of the six LLRW disposal facilities has varied from unsatisfactory to very good". This report cites the most significant problems as site instability and difficulties with surface and groundwater management. Experience at these sites also indicated that a combination of unstable waste forms, specific site characteristics and design and operational practices led to problems with water management and site instability.

The lessons learned from the operation of the three closed sites have led to a number of significant changes in procedures and requirements at the three remaining sites, as well as, the development of extensive federal guidance for developing and siting future disposal facilities.

There could be major impacts on public health and safety due to improper packaging, transportation incidents, improper design or operation of a facility, as well as natural disasters or inadvertent or purposeful intrusion into a low level radioactive waste facility.

B. Improper Packaging

Improper packaging could result in the damaging of the packages through explosive build up of gases, the action of pyrophoric liquids or in the event of a transportation accident, with a consequent release of radioactive materials leading to injury or the contamination of personnel and the environment.

Another impact of improper packaging is that it may contribute to eventual site failure, as it did, in the three disposal facilities that failed.

The three sites that have remained open have not had site performance problems, but have had incidents, for example, in 1979 a number of incidents involving improperly packaged waste and damaged waste containers were reported at both the Beatty and Richland facilities. At both facilities the improperly packaged waste was detected after it had contaminated other materials, but the extent of the release of radioactivity did not constitute an appreciable hazard.

Part M has set minimum requirements, discussed in section IV of this document, for all classes of waste intended to facilitate handling and provide protection of health and safety of personnel

during transportation and at the disposal facility. Some of these requirements are: (i) liquid waste shall be solidified or packaged in sufficient absorbent material to absorb twice the volume of the liquid; (ii) waste shall not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste; (iii) wastes containing hazardous, biological, pathogenic, or infectious material shall be treated to reduce to the maximum extent practicable the potential hazard from the non-radiological materials.

Failure to observe these technical requirements would constitute improper packaging and could result in the release of radioactive materials into the biosphere as, indeed, occurred in the examples of 1979.

C. Transportation Incidents

Transportation incidents can result in the breaking up of packages and fire leading to the release of radioactive materials into the environment and contaminating it.

In the twenty year time interval 1971-1991, there have been 53 transportation accidents involving LLRW. Of these 53 transportation accidents, only 4 involved the release of any LLRW. All of the packages that released LLRW in the accidents were strong, tight packages or Type A packages. On account of the limits of radioactive material and concentration allowed in such packages and the solid nature of LLRW, the hazard to the public was minimal (National Low-Level Waste Management Program, Technical Bulletin: EGG-LLW-10135-92-2 " Commercial Low-Level Radioactive Waste Transportation Safety History"). No Type B packages have released LLRW in a transportation accident.

D. Impacts of Improper Design or Operation of a Facility

The major impact of facility failure such as at the three sites is the threat to health and safety of the public and the environment from exposure to radioactivity.

The consequences of improper design and operation are exemplified in the failure of the three sites that have closed. A combination of inadequate waste forms and packaging which degraded in time creating voids. The voids led to crinkling of the surface and cover failure and eventual water infiltration resulting in the migration of radionuclides into the environment. The specific characteristics of the disposal sites also contributed to the migration of radionuclides. For example, the infiltrated water was trapped by the low permeability soils surrounding the trench, causing the water level to rise and inundate the waste and resulting in the migration of radionuclides. This latter process is referred to as "the bathtub effect".

E. Impacts of Natural Disaster

Earthquake motions can result in cracking or movement of concrete structures, cracking of soil slopes , subsidence of the cover of waste units, or liquefaction of loose saturated sand. Ground rupture could cause exposure of the waste or lead to rapid deterioration of disposal units by other natural forces such as storms. Severe thunderstorms and blizzards can have similar effects.

Proper site selection includes consideration of forces resulting from earthquakes. Also, design of a facility should take into account the forces associated with the maximum credible earthquake of a selected site.

A major flood during the hazardous life of any disposed waste that inundates the waste could result in the migration of radionuclides. Site selection should avoid known flood plains which have a high probability of flooding in that time interval.

A properly designed facility on a properly selected facility should withstand natural disasters without adverse impacts on public health and safety and the environment.

F. Impacts of Inadvertent or Purposeful Intrusion into the Facility

Inadvertent or purposeful intrusion into a facility could lead to exposure to external radiation and, possibly, contamination with radioactive materials.

The regulations in both 10 CFR 61 and the proposed Part M, require protection of individuals from inadvertent intrusion as one of the four performance objectives. This requirement, in Part M, states: "design, operation, and closure of a facility shall ensure protection of any individual inadvertently intruding into the facility and occupying the site or contacting the waste at any time after active institutional controls over the facility are removed." Waste designated as Class C shall be disposed of with intruder barriers that are designed to protect against an inadvertent intrusion for at least 500 years.

In the previous discussion of radioactive waste characteristics, it was indicated that stability is also a factor in limiting exposure to an inadvertent intruder, since it provides a recognizable and nondispersible waste. It is a design objective of federal regulations that Class B and C waste maintain their physical dimensions and form for 300 years. In the proposed Part M regulations the design objective for Class C wastes is that they maintain their physical dimensions and form for 500 years.

After a facility is closed and stabilized, the radiation dose rate at the surface of the cover should not exceed exposure levels allowed for the general population. The site is also placed under surveillance.The regulations in Part M require that institutional controls continue until any waste present at the site has decayed to the maximum concentrations above natural background levels permitted to be released into air or water in unrestricted areas under federal and state law. A purposeful intruder should, therefore, be detected and removed before receiving an appreciable exposure to radiation.

VI Tables

TABLE 1
MASSACHUSETTS
Low-Level Wastes Received
at Commercial Disposal Sites

Waste Generator Category	Volume (cubic feet)			Activity (curies)		
	1991	1990	1989	1991	1990	1989
COMMERCIAL	21,646	19,624	34,590	31,626	85,771	57,067
ACADEMIC	1,410	540	734	36	7	14
MEDICAL	1,471	559	876	71	4	4
GOVERNMENT	14	297	1,045	1	26	8
UTILITY	18,145	19,594	19,282	796	833	294
Total	42,686	40,613	56,527	32,530	86,641	57,386

TABLE 2
Distribution of Massachusetts LLRW
Between the Commercial Disposal Sites

Disposal site	Volume (cubic feet)			Activity (curies)		
	199●	1990	1989	1991	1990	1989
Barnwell	13,925	25,339	38,929	918	928	718
Beatty	10,333	6,695	6,636	2,520	109	45
Richland	6,700	8,579	10,962	29,031	85,641	56,623
Total	30,958	40,613	56,527	32,469	86,641	57,386

TABLE 3
Summary of 1989 LLRW Shipped for Disposal

Waste Generator Category	Volumes by Disposal Class (cubic feet)					Total Activity	
	Class A	Class B	Class C	Total	% of Total	curies	% of Total
COMMERCIAL	35852	98	0	35950	61	56853	99
ACADEMIC	2407	0	0	2407	4	14	0
MEDICAL	2113	4	0	2117	4	13	0
GOVERNMENT	609	0	0	609	1	12	0
UTILITY	16485	1149	0	17634	30	300	1
TOTAL	57466	1251	0	58717	100	57192	100
% of total	98	2	0	100		100	0

TABLE 4
1989 LLRW Produced Prior to Processing
Waste Type and Generator Category
(in cubic feet)

Waste Type	GENERATOR CATEGORY					Total
	Commer-cial	Academic	Medical	Govt.	Utility	
LIQUIDS	10,115	3,812	4,352	0	4,776	23,055
WET SOLIDS	873	2,145	837	0	4,541	8,396
SOLIDS	70,121	13,277	17,852	617	29,330	131,197
GAS	1	0	0	0	0	1
TOTAL	81,110	19,234	23,041	617	38,647	162,649
% OF TOTAL	50	12	14	0	24	100

Note: Free liquids are not for disposal. The classification as "liquids" refers to the original waste-form prior to packing for disposal. Liquids intended for disposal are immobilized by treatment processes such as absorption or solidification. Wet solids are dewatered to less than 0.5% free liquids or otherwise solidified or packaged with excess absorbents and/or additional packaging materials.